Chapter 2

Planning Considerations

CHAPTER 2 PLANNING CONSIDERATIONS

TABLE OF CONTENTS

FIGURES

TABLES

Chapter 2

Planning Considerations

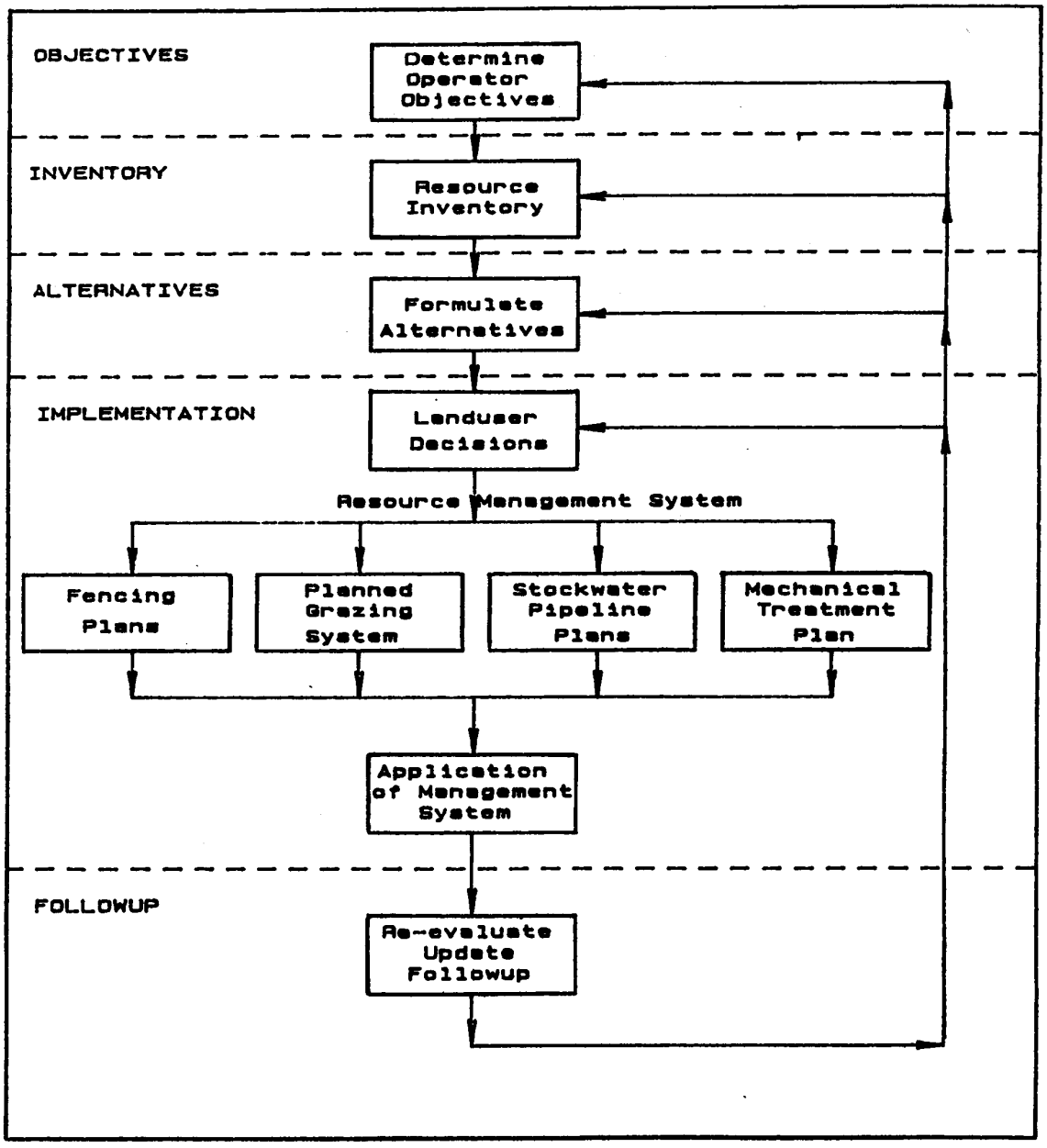
2.1 GENERAL

When planning a stockwater pipeline, it is always important to follow good resource planning procedures. Figure 2.1 illustrates the SCS planning process as it relates to stockwater pipelines. The planning processes must be followed, even when we are involved with a system where the landowner knows exactly what he wants and we are in a rush to get the job done

To do otherwise frequently leads to such problems as:

- System that does not meet resource conservation needs
- System that does not meet the needs of the cooperator
- System that cannot later be expanded
- An overly expensive system

Figure 2.1
STOCKWATER PIPELINE PLANNING PROCEDURE



2.2 PLANNING PROCEDURE

2.2.1 Objectives

Find out about the landowner's objectives. Does he or she want a more dependable supply of water, better grazing distribution, better water, or what? We also need to remember why we are involved and our objectives. They are to maintain the resource base, to maintain quality in the standard of living and to maintain or enhance the environment. We accomplish this by aiding the landuser in the development of a Resource Management System (RMS). These objectives should be clearly in mind before we start the next step.

2.2.2 Resource Inventory

Information which must be obtained when planning a stockwater pipeline system includes:

- The annual grazing period, including whether or not the pipeline will need to operate in freezing weather.
- The types and maximum number of livestock which will use water at any given time.
- The type of grazing system to be used.
- The area to be serviced by the pipeline.
- Location and details of existing water sources in the area to be serviced by the pipeline.
- Reliability and quality of existing water sources in the area to be serviced by the pipeline.
- Location, reliability and quality of water source or sources which may be used as a supply for the pipeline.
- Desirable watering locations, based on an analysis of range use patterns, range conditions, geology and topography.
- Geologic considerations including location of shallow bedrock, unstable soils, coarse gravel subsoils, old slide areas, wetland areas, sharp breaks in slope, etc.
- If wetland areas are to be traversed, a determination as to requirements or limitations involved in crossing the wetland.
- Property line and ownership considerations.
- Topographic information, including any necessary engineering surveys or study of topographic maps.

The worksheet illustrated in Figure 2.2 may be used as an aid in obtaining necessary resource information.

Figure 2.2
STOCKWATER PIPELINE RESOURCE INVENTORY WORKSHEET

U.S. Department of Agriculture
Soil Conservation Service

MT-ENG-20
1/1/92

STOCKWATER PIPELINE
RESOURCE INVENTORY WORKSHEET

Land user Ed Stockman
Job description South pasture Pipeline
Farm No. 532 Tract No. 3 Field No. 2 County Gallatin
Planner J. Tech Date 11/5/91 Checked by JCO Date 11/10/91

Type of livestock Cow-calf

Type of grazing system: [X] Conventional [ ] Intensive

Maximum number of livestock (No.) 100

Typical dates stock will be in field: From June to August

Water requirements per head (V) 20 gal/day/head at peak use.

Total usage per day (T) = no x V = 100 x 20 = 2000 gal/day.

Add 10% for evaporation and spillage: (GT) = T + 10% T (optional)
GT = 2000 + .10 x 2000 = 2200 gal/day

Minimum required flow rate (Qm) = $\frac{GT}{1440} = \frac{2200}{1440} = 1.53$ gpm.

Desired number of hours for entire days needs to be delivered:

TT = 12 hrs

Design Flow Rate: (Q) = $\frac{24}{TT}$ x Qm

Q = $\frac{24}{12}$ x 1.53 = 3.06 gpm

Desired reserve storage time (RST) = 3 days

Total reserve storage required: (RS) = RST x GT
RS = 3 x 2,200 = 6,600 gallons total storage in pasture.

Other water sources available in the field: 25 year old dam. New well drilled at homestead.

Dependability of water sources: Dam is unreliable. Well has been tested at 6 gpm

Quality of water sources: Well water is used for drinking water.

Comments:

Figure 2.2A

STOCKWATER PIPELINE RESOURCE INVENTORY WORKSHEET

NB-ENG-34
Rev. 11-73
(File Code: ENG-13)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DATA SHEET FOR TROUGH OR TANK

Natural Resource District Upper Big Blue Field Office Central City

Cooperator Henry Jones Address RR#1, Central City

Plan I.D. GACP-1032I Other No. CIN 30 Field No. 4

Planned By Charles B Lasek Date 1/2/74

Computations Checked By Stu Onyon Date 1/2/74

Storage Required

Kind of Livestock Beef Cattle

80 (No. of Livestock) x 7 (Days storage Required) x 10 (Requirement in Gal./Head/Day) = 5600 (Total Gallons Needed)

5600 (Total Gal. Needed) - 2000 (Other Storage in Pasture) = 3600 (Total Gallons Required)

Capacity

Dia. 18 Ft. Depth 2 Ft. ($23.50 \times \pi^2 \times d$)

Storage Facility = 23.50 x 9^2 x 2 = 3807 gallons

Item	Planned	Checked
Horizontal Dimensions (feet)	18' dia	18.2
Depth (feet)	2.0	2.0
Storage Capacity (gallons)	3807	3892
Wall Thickness (inches or gage)	16	16
Bottom Thickness (inches or gage)	5"	5"

Foundation, drainage, and overflow Satisfactory yes

The storage facility has been completed in accordance with applicable program specification.

Ron Ross
Signed

2/3/74
Date

USDA-SCS-LINCOLN, NEBR. 1973

5,L-32,645

2.2.3 System Alternatives

Even though the landowner may have a very specific system in mind, take an overall planning look at all reasonable alternatives to make sure the alternative the landuser wants is the appropriate one.

Economic considerations are usually a major factor in determining stockwater system alternatives. It is important not to overlook upgrading existing water sources, such as ponds, spring developments and windmills as alternatives to an extensive stockwater pipeline system or as a backup to the pipeline system in the event of failure.

The use of average per foot cost data, computer spreadsheets and specialized computer programs can be an aid to making quick analysis of various pipeline alternatives. These aids should be used whenever they will save time and effort.

2.2.4 Landuser Decisions

We sometimes forget to obtain the landuser's complete decisions before proceeding with detailed pipeline design. Good, appropriately timed communication with the landuser is always critical to success of the project. To do otherwise will usually waste everyone's time and money.

2.2.5 Implementation

Implementation of the Resource Management System includes all necessary preparation of detailed plans for such practices as fencing, range reseeding and planned grazing system as well as design and preparation of pipeline and tank drawings, specifications, quantities, cost estimates and operation and maintenance plans for the pipeline. It also includes supervision during application and construction.

2.2.6 Followup

Pipelines can be complex and may sometimes experience problems. We must be constantly alert for problems such as waterhammer, freezing pipes, erosion, low flows and improperly functioning valves so that they can be corrected and can be avoided in future jobs. This means that we must maintain contact with the landowner and re-visit at least some of the pipelines after they have operated for a period of time.

2.3 WATER QUANTITY REQUIREMENTS

The quantity of supplemental stockwater required during any given period depends on the type and number of stock, climatic conditions and amount of natural water available. It has also been found that water usage is higher for stock in an intensive grazing system.

In general, the recommended daily water requirements of livestock in Montana are as follows:

Table 2.1
RECOMMENDED DAILY STOCKWATER REQUIREMENTS
MONTANA

Livestock	Conventional Grazing System Gal/Day	Intensive Grazing System Gal/Day	Maximum Water Spacing (Mi)	
			Rough Relief	Gentle Relief
Range Cow	15	20	1/2	1
Cow & Small Calf	20	25	1/2	1
Horse	15	20	1/2	1
Sheep	2	4	1/2	1
Dairy Cow	25		1/2	1
Hog	2			
Mule Deer	2		1	2
Antelope	2		2	3
Elk	8		1	3

There will usually be additional water lost to evaporation and spillage at drinking tanks or troughs. Evaporation from a water surface can amount to as much as 0.30 inches per day in eastern Montana, and 0.20 inches per day in western Montana during the hot part of the year. Adding 10 percent to calculated animal water usage will usually cover evaporation and spillage losses. It depends on the climate, how critical the water supply is and characteristics of the system as to whether or not an evaporation and spillage replacement amount should be added.

2.4 DESIGN FLOW RATE

Minimum pipeline design flow rate must at least equal the flow rate, in gallons per minute, required to provide the peak daily water requirements in a 24-hour period for the maximum number of livestock to be run in the pasture. It is often desirable to provide additional capacity to allow tanks to refill more rapidly during the peak usage part of the day. Reasonable practice is to design pipeline capacity to provide full daily water needs in a 12-hour period.

Figure 2.3 shows flow rates required to meet daily needs in a 12-hour period. This chart assumes a 10 percent loss for evaporation and waste. Figure 2.4 shows flow rates required if flow rate is supplied over a 24-hour period.

Table 2.1A

RECOMMENDED DAILY STOCKWATER REQUIREMENTS
NEBRASKA

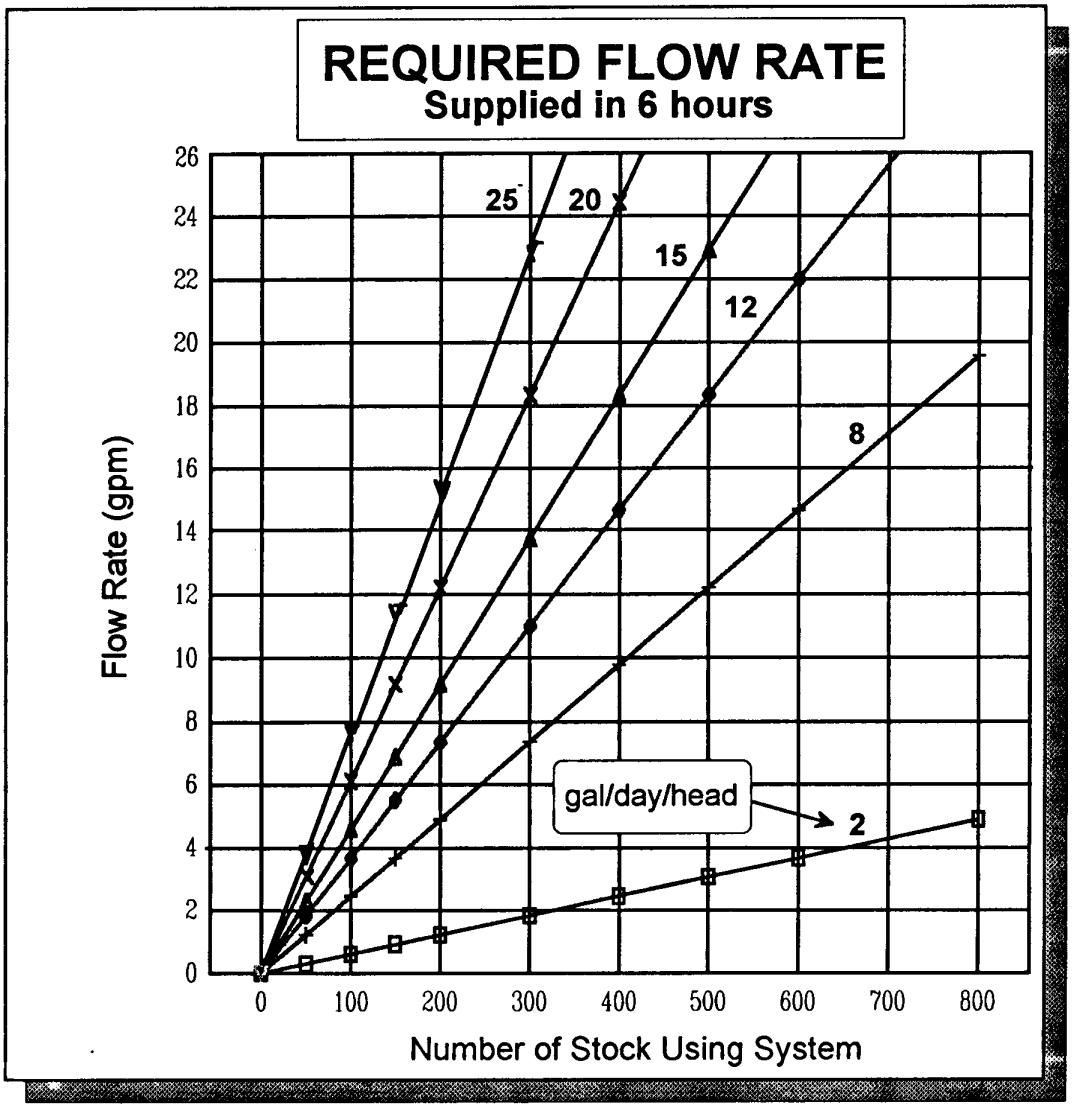
Livestock	General Water Requirements Gal/Day	Type of Terrain	Travel Distance feed to water (optimum) Miles
Cows	10 to 15	Rough	1/4 to 1/2
Sheep	1/2 to 1		
Goats	1/2 to 1	Rolling	3/8 to 3/4
Horses	10 to 12		
Elk	2 to 3	Level	3/4 to 1
Deer	1/2 to 1		
Antelope	1/2 to 1		

Table 2.1A provides general guidelines pertinent to water requirements and spacing of water facilities. They can be modified to fit conditions.

There will usually be additional water lost to evaporation and spillage at drinking tanks or troughs. Evaporation from a water surface can amount to as much as 0.22 inches per day in north-eastern Nebraska, 0.25 inches per day in the panhandle and sandhills, and 0.28 inches per day in south-western Nebraska during the hot part of the year. Adding 10 percent to calculated animal water usage will usually cover evaporation and spillage losses. It depends on the climate, how critical the water supply is, and characteristics of the system as to whether or not an evaporation and spillage replacement amount should be added.

Figure 2.3A
FLOW RATE REQUIRED FOR DAILY NEEDS (SUPPLIED IN 6 HRS)

Based on additional 10% for Evaporation and Waste



EXAMPLE:

Given: Conventional grazing system with 300 cows.

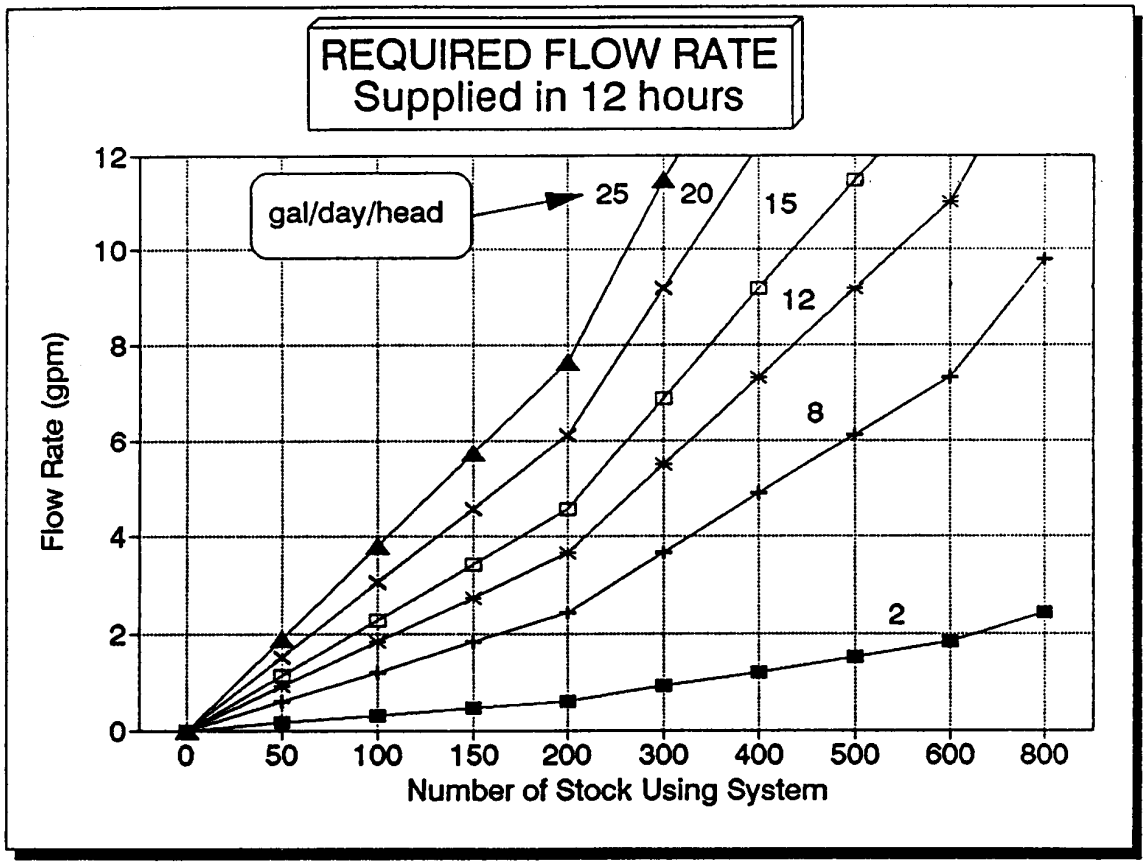
Find: Design flow rate meeting daily water requirements in a 6-hour period.

Solution:

From Table 2.1A: 15 gal/day/head required during peak use period.
From Figure 2.3A: Minimum flow requirement is 13.8 gpm.

Figure 2.3
FLOW RATE REQUIRED FOR DAILY NEEDS (SUPPLIED IN 12 HRS)

Based on Additional 10% for Evaporation and Waste



EXAMPLE:

Given: Conventional grazing system with 200 cow-calf pairs.

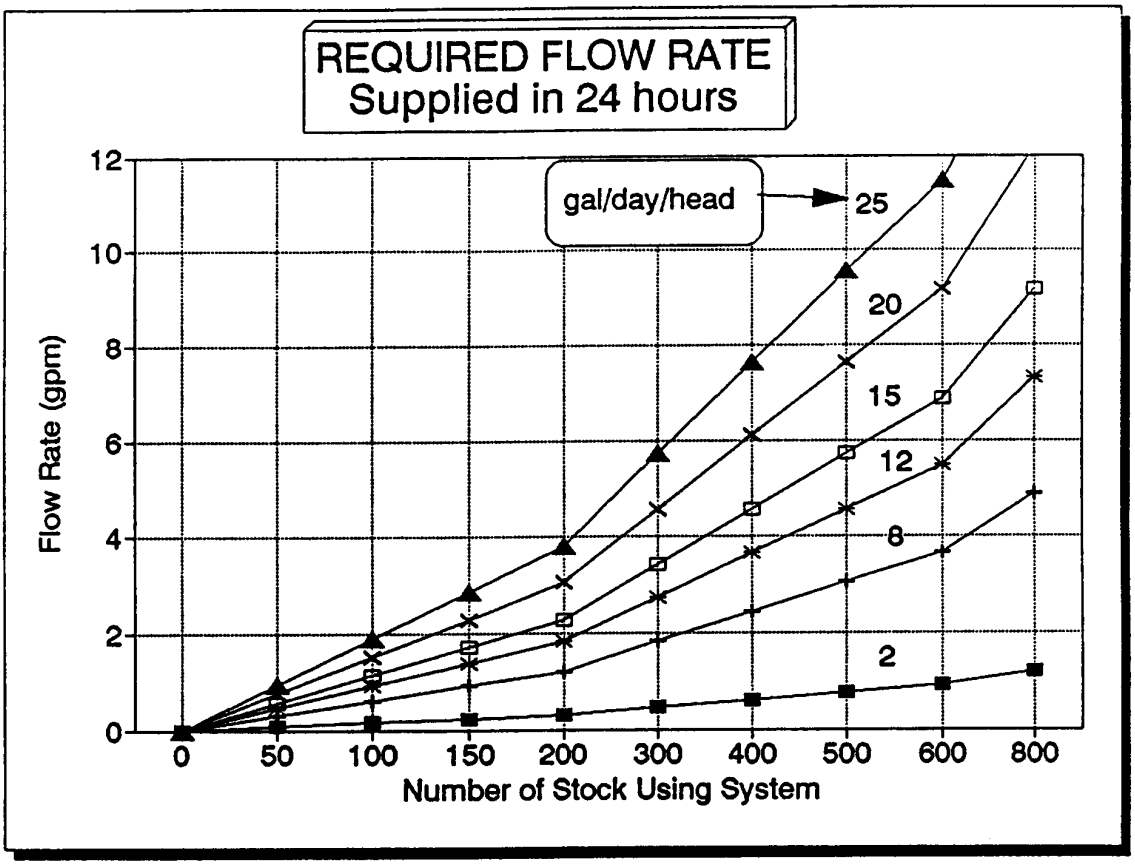
Find: Design flow rate meeting daily water requirements in a 12-hour period.

Solution:

From Table 2.1: 20 gal/day/head required during peak use period.
From Figure 2.3: Minimum flow requirement is 6.1 gpm.

Figure 2.4
FLOW RATE REQUIRED FOR DAILY NEEDS (SUPPLIED IN 24 HRS)

Based on Additional 10% for Evaporation and Waste



2.5 WATER STORAGE REQUIREMENTS

Table 2.2 shows approximate total stockwater requirements during a peak usage day. This table provides for an additional 10 percent allowance for evaporation and spillage.

The capacity of the pipeline supplied water storage facilities within a pasture must be determined on an individual basis in close consultation with the operator. In general, water storage capacity or other water sources in a pasture should be provided to meet water requirements for a minimum of three days where water supply, pipeline, power or pump failure could cause loss of pipeline supplied water. Minimum storage volume will depend the reliability of the source, the hazards of exposure of the pipeline, reliability of the supply, management provided by the operator and how easy it is to move livestock if the water supply fails.

These factors should be thoroughly discussed with the operator. In the end it is the operators decision as to how much storage is enough.

Table 2.2
TOTAL DAILY STOCKWATER REQUIREMENTS

Gallons/Day
Based on Additional 10% for Evaporation and Waste

Number of Stock Using System	WATER REQUIREMENTS - Gallons/Day/Head					
	2	8	12	15	20	25
25	55	220	330	413	550	688
50	110	440	660	825	1,100	1,375
75	165	660	990	1,238	1,650	2,063
100	220	880	1,320	1,650	2,200	2,750
125	275	1,100	1,650	2,063	2,750	3,438
150	330	1,320	1,980	2,475	3,300	4,125
175	385	1,540	2,310	2,888	3,850	4,813
200	440	1,760	2,640	3,300	4,400	5,500
250	550	2,200	3,300	4,125	5,500	6,875
300	660	2,640	3,960	4,950	6,600	8,250
350	770	3,080	4,620	5,775	7,700	9,625
400	880	3,520	5,280	6,600	8,800	11,000
450	990	3,960	5,940	7,425	9,900	12,375
500	1,100	4,400	6,600	8,250	11,000	13,750
600	1,320	5,280	7,920	9,900	13,200	16,500
700	1,540	6,160	9,240	11,550	15,400	19,250
800	1,760	7,040	10,560	13,200	17,600	22,000
900	1,980	7,920	11,880	14,850	19,800	24,750
1000	2,200	8,800	13,200	16,500	22,000	27,500

Table 2.3 tabulates storage capacity for round stock tanks.

Table 2.3
ROUND STOCK TANK STORAGE CAPACITY

Gallons

Tank Diameter (feet)	TANK DEPTH (feet) (Filled to within 3" of top)					
	1.0	1.5	2.0	2.5	3.0	3.5
4	70	117	164	211	258	305
6	159	264	370	476	582	687
8	282	470	658	846	1,034	1,222
10	441	734	1,028	1,322	1,615	1,909
12	634	1,057	1,480	1,903	2,326	2,749
15	991	1,652	2,313	2,974	3,635	4,296
20	1,762	2,937	4,112	5,287	6,462	7,637
25	2,754	4,589	6,425	8,261	10,096	11,932
30	3,965	6,609	9,252	11,896	14,539	17,182
36	5,710	9,516	13,323	17,130	20,936	24,743
40	7,049	11,749	16,448	21,148	25,847	30,546

Where a windmill is involved, and other water sources are not available, a minimum of 10 days' livestock water requirement plus about 10% evaporation and spillage loss should be provided in storage tanks.

There is no hard and fast rule as to how much emergency water storage is adequate. Much depends on how the operator operates. For example, if he is checking his stock every couple of days, less storage would be required than if he checked them only once a week.

Storage also depends on how easy it would be to move the stock to another field where water is located, should the water supply in the field where the stock is located be interrupted.

How much emergency storage is enough is a management decision that should be made by the operator after thorough discussion of all factors involved.

2.6 SOURCE OF WATER

Water for stocklines usually is obtained from wells or springs. Occasionally a surface source is used.

2.6.1 Springs

Springs often have varying degrees of dependability. If it is proposed that an extensive pipeline be run from a spring, the spring should be developed and used for a couple of years to prove its yield and dependability before installing an extensive pipeline.

Sediment, moss, scum, fish, frogs, mice, and other solids must be excluded from spring pipelines to the extent possible. Where the spring

collection system allows entry of this type of material, a spring box with screened pipe inlet must be employed. If a gravel/pipe type of collection system is used, a spring box is usually not necessary.

2.6.2 Surface Source

Special care must be used to exclude scum and sediment from pipelines using a surface water as a source. A screening or filtering device should always be used at the entrance to the pipeline. If sediment is a problem, consider constructing a settling pond at the entrance to the pipeline.

2.6.3 Well

Some wells produce considerable amounts of sand. A sand separator should be installed at the beginning of the pipeline in such a case. Sand separators are available through trickle irrigation supply sources.

2.6.4 Water Quality

Montana Technical Note Environment No. 13, Assessing Water Quality, provides details of stockwater quality requirements. The most common factors to consider are salinity and nitrates. Tables 2.4 and 2.5 describe tolerable levels of these elements.

Table 2.4
USE OF SALINE WATER FOR LIVESTOCK

Total Dissolved Solids mg/l	
1,000-3,000 mg/l	Very satisfactory for all classes of livestock. May cause temporary and mild diarrhea in livestock not accustomed to them.
3,000-5,000 mg/l	Satisfactory for livestock but may cause diarrhea or be refused at first by animals not accustomed to them.
5,000-7,000 mg/l	Can be used with reasonable safety for dairy and beef cattle, sheep, swine, and horses. Avoid use for pregnant or lactating animals.
7,000-10,000 mg/l	Considerable risk in using for lactating cows, horses, sheep, or for the young of these species. In general, use should be avoided although older ruminants, horses, and swine may subsist on them under certain conditions.
Over 10,000 mg/l	Risks with these highly saline waters are so great that they cannot be recommended for use under any conditions.

Table 2.5
EFFECTS OF NITRATES ON LIVESTOCK

Nitrate Concentration (mg/l NO3 as N)	Effect
10-30	Slight possibility of harm
30-50	Risky, especially over a long period of time
50-100	Interference syndrome likely (trembling, weakness, discolored urine)
100-145	More serious; possible acute losses
145-195	Increased acute loses, secondary diseases
195 up	Acute losses.